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Looking to a Green Future

What Can We Expect For The Green-Building Movement And our Planet?

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At one time or another, we all have wished for the ability to predict our futures. Today's greatest concern may be what the future holds for our existence on this planet. As we know, the green-building industry has grown exponentially in the past few years. But is its work enough to change the fact that our buildings consume 71 percent of the nation's electricity and 12 percent of its water?

And is the U.S. on the right path to reverse, halt or at least slow the damage already being done to our environment?

The year 2030 is the deadline to achieve zero-energy buildings.

This target was set by the 2030 Challenge, an initiative created by Ed Mazria, director of the Santa Fe, N.M.-based nonprofit Architecture 2030. The challenge has been adopted by the American Institute of Architects, Washington, D.C., and U.S. Green Building Council, Washington, as well as many other organizations and municipalities. With only 22 years left to meet the challenge, eco-structure asked several construction and design experts to share their predictions about the year 2030. They discussed whether green building will be innate to the construction process, the implications of climate change on our buildings, future energy sources and the lifestyles we can expect to lead. Read on to see how the buildings in which you live and work may change by the year 2030.

KAREN P. BUTLER, manager for commercial building design for Energy Star, a program of the U.S. Environmental Protection Agency, Washington, D.C. My visceral sense thinks there will be an expression of new and old architecture forms in buildings as we approach 2030. I say new because technology has advanced how we design and construct buildings and provided materials that weren't available 30 years ago. I say old because I grew up in Washington, D.C., when most dwellings' energy needs were sustained through much more passive means than we know today. In summer we cooked outdoors, slept downstairs in a partially subterranean basement because it was cooler and hung laundry on clotheslines for drying. In winter months, sunlight streamed through a large window in the dining room, providing a warm place to have meals and do homework. How will buildings perform and respond to energy needs in 2030? The "McMansion" will be replaced by flexible dwellings for multigenerational families. These dwellings will be sited to take full advantage of as many passive strategies as possible, including outdoor kitchens, laundry-drying areas and rainwater collection in permissible climates. Homes will be designed to expel heat in summer through ceiling or clerestory openings and take in cool air from openings closer to the ground. The fireplace will no longer be a decorative feature defining an exterior wall; it will be centrally located and used for primary heating, as well as gathering places in colder months.

Dwellings situated in natural settings would provide a sanctuary to listen to the birds sing. Our spaces will be reflective of our struggles with rising energy costs and resource scarcity. We must educate ourselves about how the buildings where we work, play, learn and shop can sustain us without exhausting natural resources and energy. Energy efficiency along with thoughtful design will harness resources that are free and abundant and inform how we design our buildings. Frank Lloyd Wright embraced sustainable design and its connection to natural elements in most of his work.

At Taliesin West, built more than 70 years ago in Scottsdale, Ariz., he used materials from the site to construct the building, created ways to move seamlessly from inside to outside, created breezeways and airflows by strategic placement of glazing, reduced temperature fluctuations with selective massing considerations, and created synergy with the landscape to add delight and shelter from the elements.

So will buildings in 2030 resemble Wright's work? Replicating a body of work is not as informative as understanding the guiding principles that influenced the decision-making process. History does inform us, however, that the aesthetic and building form of so-called 2030 architecture need not be banal or exorbitant. Instead, it is personal and reflective of the vernacular where we reside and carry on with our lives.

ANDRE DESJARLAIS, group leader for building envelopes research, Oak Ridge National Laboratory, Oak Ridge, Tenn.; the laboratory is managed by the U.S. Department of Energy, Washington, D.C. From an energy perspective, DOE's goal for the year 2030 is for buildings to be energy neutral, meaning they will use as much energy as they produce on a yearly basis. Effectively we'll have taken buildings, which consume about one-third of all the energy used in the U.S., off the map in terms of energy. I think the cost of energy and desire to become more energy independent will drive us in that direction. I don't think 2030 buildings will look different from today's buildings except that they will have some form of local energy production. I think for residences, it primarily will be photovoltaics. Colleges and office facilities might implement wind or another form of renewable energy. I think there will be more gadgets in buildings. For example, we'll have sensors that will trigger ventilation equipment when needed. Our parents' homes had one television and a radio; ours have eight TVs, seven computers, a second refrigerator, and all those things are using energy, which is part of the energy consumption of the building. During the past 20 years, we've been losing the battle for energy efficiency in two areas—the size of homes and plug loads. Houses are getting bigger, so even if we save energy per square foot, houses that are twice as big eat up more energy.

Plug loads are increasing substantially because of all our extra toys. To achieve zero energy, we have to have some local generation. I think we also need to get to a point in which people are willing to pay the extra costs associated with green construction. A big problem with the way we build today is we don't really look at service costs; we look at first costs. Typically, the only thing that attracts a buyer is the price on the for-sale sign, not how much energy they're going to use on a monthly basis.

By 2030, I don't expect there to be such a disconnect between what's green and what's good design and construction as there is today. For example, people forget that roofs are meant to keep water out of buildings, so we shouldn't be specifying a roof type to get a credit in a greenbuilding rating system. We should be picking roofs first to perform their function and then if you can get a cool-roof credit, as well, great. We should be trying to make our buildings do more—not just be green. A good example proving we can meet our 2030 energy goals is the state of California; its per-capita energy consumption today is exactly what it was in 1980. The state's residents pay for it in taxes and high energy prices, but California has demonstrated it can be done. California hasn't actually begun improving its environment but it certainly has been able to hold the line. I hope that nationally by 2030 we will be able to at least say we're holding the line.

S. RICHARD FEDRIZZI, president, chief executive officer and founding chair of the U.S. Green Building Council, Washington, D.C. At USGBC, we envision a future in which all our buildings and communities sustain the health and viability of life on our planet and improve the quality of life for everyone. We believe we can get there within a generation. At that time, we will no longer have to talk about green building because that phrase will be obsolete. Sustainable building practices that protect occupants' health, preserve our natural resources, and keep our air clean and climate stable will be the norm.

And building professionals will consider it second nature to take social equity into account when making decisions about product selection, building science and labor practices. Our buildings will protect the health and well-being of everyone, regardless of where we live, what we earn and how we live our daily lives. Today, few builders would dream of building structures without implementing fundamental safety and accessibility safeguards that 50 years ago would have been seen as unnecessary. Similarly, we see a future where buildings won't be built unless they are efficient, high performing, healthy and sustainable. And this change won't be dependent on the altruism of builders or mandates from government.

It will simply be the most economically feasible, profitable way of doing business, and the market will demand it. Owners will demand their buildings protect occupants' health, cost less to operate and contribute to humanity's efforts to undo the damage we have done to our environment. Building professionals will find that green-building techniques make it easier for them to consistently turn out a better product with less time and money wasted and more happy customers. In a lot of ways, this forward momentum will begin with a move backward. Our quality of life will be greatly improved when we return to the simpler, more-natural lifestyles of our parents' and grandparents' generations. My grandparents grew their own food in their backyards. Everything they bought was locally produced. They reused everything they could. Neither of my sets of grandparents owned a car, and they were able to thrive nonetheless. For my grandparents, there was little choice but to live this way. The difference for us will be that we will be conscious of our sustainable lifestyles, able to reap the benefits of a healthier life fully aware of how we have improved our lives and the lives of our human family. And, perhaps a bit ironically, the tremendous advances in technology we have made in recent generations and are certain to continue making will only make it easier for us to live responsible, healthy lives in a truly sustainable built environment.

ASHRAE is on a countdown to zero-energy buildings by 2030. Rising energy costs and growing public concern about limiting buildings' impact on the environment have

demonstrated that the organization's members are going to need design guidance to achieve zero energy. We now are working to have an ASHRAE Advanced Energy Design Guide to help in the design of zero-energy buildings by 2015. To hit that target means substantial changes for the building industry, such as moving beyond minimum energy requirements, advancing to a truly collaborative design process, and doing a better job of educating building owners and developers about how to effectively use life-cycle costing when evaluating alternatives.

I believe one of the fundamental changes in how we design buildings will be a switch to a building-information-modeling-based integrated design process. I envision a future where building orientation, envelope, fenestrations, shading and overhangs are designed with real-time feedback from the mechanical consultant documenting the energy impact of those decisions. The integrated design process also must consider the effect building design will have on maintainability of equipment, which will affect energy usage throughout the entire life of a building. A BIM-based design allows building owners to better train and retrain their operators. "Can You Achieve 150% of Predicted Retrofit Savings: Is it Time For Recommissioning," a study from Texas A&M University [College Station] shows energy use in buildings could be reduced by 10 to 40 percent by improving operational strategies. Much of the decay in building performance is because operators lack training in the sophisticated systems used in high-performance buildings.

As we march toward our global building performance goals, I see building codes moving from minimum requirements to higher levels of energy savings. This already is occurring with development of Standard 189.1P, "Standard for High-Performance, Green Buildings Except Low-Rise Residential Buildings," by ASHRAE, the Washington, D.C.-based U.S. Green Building Council and New York-based Illuminating Engineering Society of North America. ASHRAE also is helping raise minimum energy requirements by making provisions of Standard 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings," significantly more stringent. Last year, I heard Sen. John Glenn [D-Ohio] speak.

He commented about how beautiful the Earth looks when viewed from space. He also noted that from space, our atmosphere appears to be very thin. When you go outside and look up, the sky seems to extend forever, but only about the first 25,000 feet [7603 m] of the atmosphere supports life. If you modeled that on a 12-inch [305-mm] globe, the layer of air we can breathe is about the thickness of a business card. How long are we going to continue to use our fragile and precious atmosphere like a landfill, dumping 33 to 44 billion tons [30 to 40 billion metric tons] of carbon dioxide into it every year? Buildings account for 40 percent of primary energy use in developed countries. Much of

that energy use can be avoided by improved design and operating strategies. For those of us who understand that simple truth, it is our duty to attack that wasted energy, and I think we will.

WARD HUBBELL, president of the Green Building Initiative, Portland, Ore. Since the turn of this century, we have suffered through several catastrophic events that collectively are restructuring our way of life. The first was a tragic reminder of the risks of relying on hostile nations for the economic lifeblood of our economy—oil. The second came in the form of a hurricane as we finally began to understand the risks associated with global climate change. For those who still weren't convinced that we needed a new approach, \$140 per barrel of oil did the trick. If there is good to come of these events, it is that they have formed the critical mass necessary to move us toward a more efficient, sustainable model for building and powering our world. While education has had a significant impact on changing our behavior, economic realities have been the real forces behind the recent drive toward green building, hybrid cars, renewable energy and the explosive growth of other subsectors in sustainability. The cost of fuel has and will continue to have more to do with the pace of the green movement than anything we could ever do from an education perspective. That's why, by 2030—and probably a lot sooner—I believe green building will be standard practice because the economics will support it. But it won't be called green building; it will simply be how we do things.

Today, you might feel conspicuous if you're not replacing your incandescent light bulbs with compact fluorescents; by 2030, you will feel that way if you're not almost completely reliant on renewable sources for your power. Don't expect to see a lot of futuristic buildings or, for that matter, mud or straw-bale homes. Buildings will look much like they do today, but they'll be a lot more self-sufficient. Hopefully, they'll be off the grid from an energy perspective and much more water conscious. In other words, the types of changes we'll see in buildings 20 years from now will be an extension of what's happening in green design and construction today. All of this means the window of opportunity is limited for those of us who certify green buildings. By 2030, we'll be past the days of hanging plaques. Instead, we'll increase our focus on training as technologies and construction practices continue to evolve. My youngest child began second grade this year and I'm quite confident that before my wife and I are empty nesters, many of the things we now consider innovative will be standard practice. There are those of us who have been conservationists for a long time out of a sense of personal responsibility.

But, in the end, it doesn't matter what brings someone to the sustainability movement—whether education or economics—as long as he or she reduces environmental impact

and is committed for the long term. By 2030, I think buildings will be as close to zero energy as we can get. I think we'll see a return to regional forms and expressions in architecture because buildings will be designed to better respond to local conditions.

We'll also see more sophisticated buildings because, at that point in time, we'll have a lot more information to guide our designs and analysis tools that will help us design buildings that perform much better than they do today. This additional information will allow architects to model buildings that optimally interact with their environment wherever they are located. Rather than importing energy to essentially overpower the exterior environment, architects will use the natural setting to do the things machines and fossil-fuel energy are doing now. Designing a building with its environment in mind will dramatically reduce the amount of energy—whether it's fossil fuels or renewable energy—needed to operate that building. Because we'll always need some type of imported or on-site energy to operate buildings, I think we'll see a conversion to on-site renewable generation of energy, such as capturing and transforming solar and wind energy into usable electricity within the building.

I also think that in the future we will be buying whatever renewable energy we can't produce on site from a central utility or a community-scale utility system. By 2030, the term green building will no longer be in existence because we'll have to build green. The finite nature of our fossil-fuel energy and other resources will force non-green buildings out of the picture. We're running up against the peak of oil right now; natural gas is not far behind. Even our other fossil-fuel resources are limited. This will force us to move into a different type of built environment in the very near future. I think we're moving toward that path now. The question is, "Will we get there fast enough?" To ensure that we get on the path soon, we need more action and direction on what needs to be done from the federal government. Right now, the leadership on this issue is really at the state and local levels, so you don't have the entire country moving in that direction.

My hope is that by 2030 we will have halted and begun the reversal of the environmental conditions we've set in motion to date. My understanding is that the process of climate change can be slowed and we can continue to live within the conditions we've created to this point. However, if we continue on the path we've been on, living within the resulting climate may be a lot more difficult for us in the future.

MARSHALL E. PURNELL, FAIA, design principal of Devroux + Purnell Architects and Planners PC, Washington, D.C., and 2008 American Institute of Architects president By 2030, new or substantially renovated buildings designed by architects will be carbon neutral, because that's just how we'll design and build. Reaching carbon neutrality for all

buildings is a huge challenge, because there are so many buildings that are part of the existing fabric, and it will take time and resources to green them. I don't think buildings of 2030 will look substantially different from today. To reach carbon neutrality, buildings must produce some energy on their own, and integrating systems into the skin of a building reduces the visual impact of the traditional photovoltaic array. Green roofs and the integration of PV into the skins of buildings probably will be more prevalent. We have the design option of making PVs part of curtainwalls not only for electricity, but also as shading devices, which can be visually stunning and a vital part of controlling the sunlight that enters a building through the skin. We can explore this idea of letting in light without letting in heat with a lot of different materials. I also believe we'll have sensors in our buildings that will track the sun and weather and make buildings do certain things accordingly, such as ventilate naturally. We'll certainly be more aware of how we heat and cool buildings in 2030. Geothermal is not as widely used as it could be. I think economically having access to this and other types of super-efficient technologies is a very important step, perhaps through expanded local, state and national incentives for the use of renewable-energy sources. In terms of scarcity, I think water is the next oil. It's already a concern in certain parts of the country. Eventually, but probably not by 2030, we may need to move water from one part of the country to another.

A smarter solution would be to make rainwater catchment for buildings the standard, and not the exception. The Great Lakes comprise 10 percent of all the fresh water on Earth but that doesn't help the folks in Las Vegas. Sustainable solutions for potable water where it is a scarcity will be a major challenge in the near future. I hope by 2030 we'll have halted the damage done to our environment, but I fear that we will not have reversed anything. This new national focus on the environment is like moving a big ship; we're now slowing the propellers but don't have any reverse action yet.

We are down the negative road farther than we'd like to be, but there's still hope and there are a lot of questions yet to be answered, like where we are as an industry. We need to start thinking about the long run, including implementing a long-range energy policy and action plan for our country. We're on the right path to achieving the 2030 Challenge, but I wish the path was less winding. I think the public is becoming more aware of this issue of sustainability and energy conservation, but it needs education to start integrating those things in a more real way. Although each of the leaders eco-structure interviewed was gazing far into the future, they agree more must be done today to meet the goals set forth by the 2030 Challenge.

Perhaps next month’s presidential election will have an effect on our nation’s environmental conscience. No matter the outcome of the election, it is important that the green-building industry continue to grow in knowledge and size, designing and constructing intelligently while conserving our resources and affecting change. Like these industry leaders, we at eco-structure look forward to the day when green building is innate to design and construction.

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